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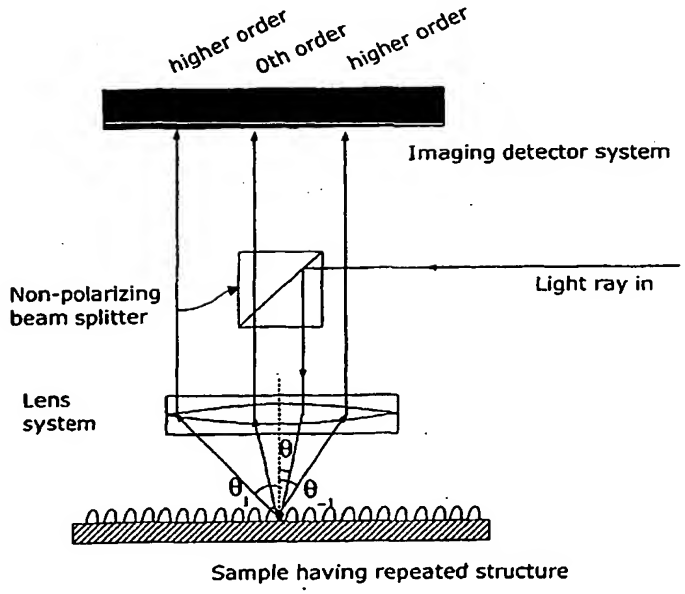
(54) Title: METHOD AND APPARATUS FOR OPTICALLY MEASURING THE TOPOGRAPHY OF NEARLY PLANAR PERIODIC STRUCTURES



(57) Abstract: The present invention discloses a non-destructive method and apparatus for measuring the 3D topography of a sample having periodic microstructure deposited onto the surface, or deposited onto a film, or buried into the film or sample. In particular, the present invention relates to an optical system and method utilizing polarized light beam, diffracted from the repeated structure, to measure its spatial geometry giving parameters such as profile height, profile widths, sidewall angles, and arbitrary profile shape. The optical system employs a broadband or semi-monochromatic light source to produce a light beam that is polarized and focused onto the periodic structure being measured. The focused beam consists of a whole range of illumination angles that is provided to the structure simultaneously. Transmitted or reflected diffracted light generated by the interaction of the light with the periodic structure is collected by an imaging detector system. The detector records the diffraction light irradiance resolved into illumination angles, diffraction orders and wavelength. The data is applied to determine the geometrical profile of the periodic structure using a reconstruction algorithm that is based on comparisons between measured diffraction data and modeled diffraction irradiance of a profile model using Maxwell's equations. The reconstruction of the profile is performed by iterative adjustments of a profile seed model until the modeled diffraction irradiance matches the measured data within a predefined convergence tolerance.

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